

*The preservice teacher
knows the discipline...*

Unified Science Education

*(including Secondary Endorsements in Biology,
Chemistry, Physics, and Earth Science)
(Grades 9-12)*

The beginning (preservice) science teacher will demonstrate a knowledge of and/or competency in the following areas of study:

Introduction

The following competencies are intended to clarify Standard 1.1, “. . . knows the discipline,” in the Missouri Standards for Teacher Education Programs MoSTEP process. The competencies are firmly rooted in the profession’s best knowledge and practices. They are drawn from guidelines established by the National Science Teachers Association and National Research Council. The competencies are broadly stated with the intent that teacher preparation institutions will determine the breadth and depth of material for meeting the competencies. The statements represent the minimum expected of beginning teachers.

The accompanying document prepared and reviewed by the science education committee members includes the topics that a science teacher should know. Each individual will have to develop his/her understanding and ability to present such material in the depth appropriate for the grade level taught. Higher education institutions have the challenge to develop courses that will include the topics and present them with academic rigor and with sufficient depth to prepare future teachers.

The areas of study are grouped under broad topical headings. Professional science educators will recognize that many topics incorporate other concepts that must be presented to enable the student to understand and attain the competencies. Each instructor will use the listing as a broad outline or guide to develop a curriculum that has some consistency statewide while maintaining the flavor of the home institution and faculty member(s).

The section NATURE OF SCIENCE includes themes or applications that should permeate all content areas. These ideas are listed separately but must be incorporated throughout the content. It is expected that the courses will be inquiry-oriented; that is, the primary focus will be “doing” science: observing, experimenting and communicating the results of research (laboratory or field work). The use of computer technology—especially interfacing measuring instruments, mathematical and statistical software, and Internet search systems—is essential for scientific study and is to be a natural part of the science teacher's repertoire. The other themes remind the future teacher that science is a human endeavor that continues to change as new or refined information is obtained.

MATTER AND ENERGY deals with what it is, how it changes, and how it is measured. In FORCE AND MOTION the student learns how things move or are moved. The section LIVING ORGANISMS illustrates common features of different types of living organisms and how they live and function. The interactions of organisms with their environments and the effects of interventions in environments are the topics in ECOLOGY AND ENVIRONMENTAL SCIENCES. Since all of this takes place on Planet Earth, the student studies EARTH PROCESSES AND INTERACTIONS. Field trips, mapping skills and the use of interactive computer programs greatly enhance learning in this and the following section. SPACE SCIENCE expands the students' horizons to include the broadest perspectives of the final frontier.

The preservice teacher who successfully completes such a program of study and who can demonstrate a knowledge of and competencies in these areas will be well prepared to teach science. However, it is to be emphasized that this is only the beginning in the individual's continuing professional development.

The beginning (preservice) science teacher will demonstrate a knowledge of and/or competency in the following areas of study:

<p>1. The Nature of Science (S 1-8; CR A 1-7, B 1-7, C 1-7, D 1-7)</p>	<ol style="list-style-type: none"> 1. The processes of scientific inquiry; (NSTA 2.9, 2.11, 3.4, 3.11, 8.5) 2. The relationships among the sciences; (NSTA 2.8, 3.8, 8.1-2) 3. Interactions of science, technology, and society; (NSTA 2.1, 2.9-10, 3.1, 3.9-10, 4.1, 4.6, 8.4) 4. The appropriate use of measurement, mathematics, and technology; (NSTA 2.12, 3.12, 8.3) 5. The historical development of science theories and knowledge; (NSTA 4.8, 8.5) 6. Career opportunities in science; and (NSTA 1.2) 7. Legal, ethical, and safety issues.
<p>2. Matter and Energy (S 1, 7-8; CR A.3-4, B.3-4, B.7, C.3-4, C.7, D.3-4; NSTA 6.1-5, 9.1-5)</p> <p>3. Force and Motion (S 2, 7-8; CR A.4, B.4, C.4, C.7, D.4, D.7; NSTA 9.1-5, 10.1-5)</p>	<ol style="list-style-type: none"> 1. Properties of matter; 2. Elements and compounds; 3. Mixtures and solutions; 4. Chemical, physical, and nuclear changes; 5. Energy transformations; 6. Wave and particle characteristics of matter and energy; 7. Conservation of mass and energy; and 8. Gas laws. 1. Momentum and inertia; 2. Work and energy; 3. Kinetic and potential energy; 4. Magnetism and electricity; 5. Acceleration and velocity; 6. Forces; and 7. Simple machines.

The Science Education competencies have been developed to correlate with the following documents:

- Missouri's Show-Me Standards abbreviated as:
S 1,4 = Science Education section, statements 1 and 4
- Missouri's minimum requirements for Unified Science Education certification, effective September 1, 1997 abbreviated as:
CR B.1 = Certification Requirement number 1 under the Chemistry Endorsement
- National Science Teachers Association (NSTA) guidelines as reprinted in the National Council for the Accreditation of Teacher Education Approved Curriculum Guidelines abbreviated as:
NSTA 8.4 = Standard 8.4

The beginning (preservice) science teacher will demonstrate a knowledge of and/or competency in the following areas of study:

4. Living Organisms (S 3, 7-8; CR A.1-7, B.2-6, C.2-6, D.2-6; NSTA 5.1-6, 9.1-5)	1. Classification; 2. Reproduction and heredity; 3. Human anatomy and physiology; 4. Cellular structure and function; 5. Photosynthesis and respiration; 6. Human body; and 7. Structure and function of organisms within each kingdom.
5. Ecology and Environmental Science (S 4, 7-8; CR A.2, A.5-7, B.2, A.5-7, C.2, C.5-6, D.2, D.5-6; NSTA 5.1-6, 6.1-6)	1. Ecosystem dynamics and interactions of organisms with their environments; 2. Adaptations, evolution, and natural selection; 3. Energy flow and biogeochemical cycles; 4. Population and community interactions; 5. Biomes and biosphere; and 6. Conservation and sustainability.
6. Earth Processes and Interactions (S 5, 7-8; CR A.3, A.5, B.3, B.5, B.7, C.3, C.5, D.3, D.5, D.7; NSTA 7.1-5)	1. Natural resources; 2. History, structure, and composition of Earth; 3. Hydrosphere; 4. Plate tectonics; 5. Rocks, minerals, and fossils; 6. Weathering and erosion; and 7. Atmospheric science.
7. Space Science (S 6-8; CR A.3-4, A.7, B.3-4, B.7, C.3-4, C.7, D.3-4, D.7; NSTA 7.1-5)	1. Earth-Moon systems; 2. Characteristics and composition of solar system(s); 3. Characteristics, composition, and evolution of stars; 4. Characteristics and composition of galaxies; and 5. Characteristics composition, and evolution of the universe.

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Development Committee

Certification Requirements, Unified Science, grades 1-12, Missouri State Board of Education, effective 1997.

Competencies for Beginning Teachers in Science Education, Missouri Advisory Council of Certification for Educators-MACCE, accepted by Missouri State Board of Education, 1994.

Handbook for Continuing Accreditation Visits, National Council for Accreditation of Teacher Education-NCATE, February 1994. Prepared by the National Science Teachers Association.

Missouri's Frameworks for Curriculum Development, Missouri Department of Elementary and Secondary Education, 1996.

Model Standards for Beginning Teacher Licensing and Development: A Resource for State Dialogue, Interstate New Teacher Assessment and Support Consortium-INTASC, Sponsored by the Council of Chief State School Officers.

National Science Education Standards, National Research Council, 1996.

New Standards for Teacher Education Programs in Missouri-MOSTEP for Institutions Seeking Continuing Approval of Teacher Education Programs (draft 2/96).

Next Steps: Moving Toward Performance Based Licensing in Teaching, Interstate New Teacher Assessment and Support Consortium-INTASC.

The PRAXIS Series, Professional Assessments for Beginning Teachers, Educational Testing Service, July 1994. Specialty area test descriptions.

Redesign of licensure of Kansas educators, Kansas State Board of Education, February 1996.

"The Show-Me Standards," Missouri Department of Elementary and Secondary Education.